

## ERGONOMICS IN ORTHODONTICS - A REVIEW

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### ABSTRACT

*We neglect the body comfort in order to achieve the best practice in dental field due to which either mind, body or soul may not coordinate or function to our need. Such malfunction may result in loss of psychological or physical well being. So work related musculoskeletal disorder is commonly noticed among general, orthodontic and even other speciality practitioners. Such disorder may interrupt the dental practice of an Orthodontist for the time being or sometimes enduringly. Work related disorders depend on Orthodontist based and non-Orthodontist based factors. Orthodontist based factors such as duration of work, posture and equipments. Non-Orthodontist factors are environmental factors such as temperature, noise and light etc. This review discusses the aetiology, factors governing the ergonomics and corrective measures for proper position and handling the dental materials in orthodontic practice.*

**KEYWORDS:** *Musculoskeletal Disorders, Four Handed Orthodontics, Ergonomic*

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### INTRODUCTION

In Greek, “Ergo,” means work and, “Nomos,” means natural laws or systems. It is an applied science deals with scheming products and actions for sufficient competence and protection for the subjects. Learning ergonomics fine-tune the subjects to know the easiest way or simplify the work to formulate it more efficient.<sup>1</sup> Improving the ergonomic practice in dentistry enhance the comfort and safety for dental practitioners, dental staff, and patient.<sup>1</sup>

Results from the previous studies states that 88% of dental practitioners have good or excellent health. But reports from certain studies states that three out of ten dentists have poor physical state. Such reports can cause dentist to experience several musculoskeletal disorders that can interrupt practice dentistry.<sup>2</sup>

Working environment for an Orthodontist differ from their counterparts working in foreign milieu. Orthodontist prefers working as academicians, private practitioners and as consultants in various clinics and multispecialty hospitals. Further Orthodontic professionals do not restrict themselves to their speciality in dental practice. Orthodontic speciality necessitates a range of the finest movements in coordination with vision and unsupported arm work. This increases the duration of work resulting in the stress and strain to the muscles and bones causing musculoskeletal disorder.<sup>3</sup>

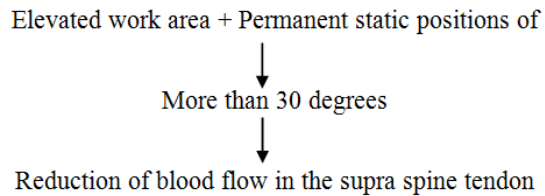
Specialist in Orthodontics usually suffer from such musculoskeletal problems, which are due to suboptimal ergonomics that is liable for inappropriate sitting position and actions causing work related musculoskeletal overload, uneasiness, and exhaustion.<sup>4</sup> Such musculoskeletal disorders can cause pain and dysfunction of the neck, back, and hands and fingers. Around 54-93% of practitioners has developed work related

musculoskeletal disorders, with the most frequent injuries occurring in the spine, shoulders, elbows and hands.<sup>5</sup>

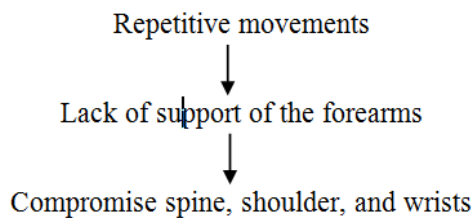
### Etiology

Lake in 1995 implicates several mechanisms in the generation of pains and soreness in dentists, such as

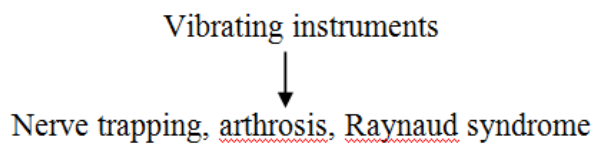
#### Raised work area



#### Support

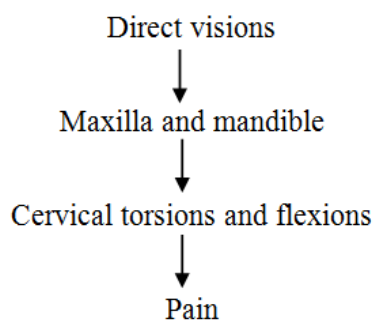


#### Handling

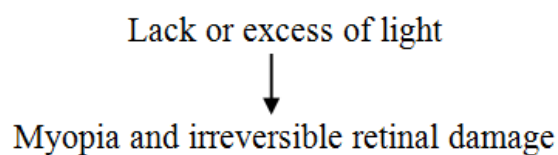


#### Forced Cervical Static Postures

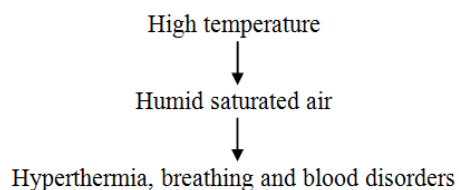
##### Posture



#### Light



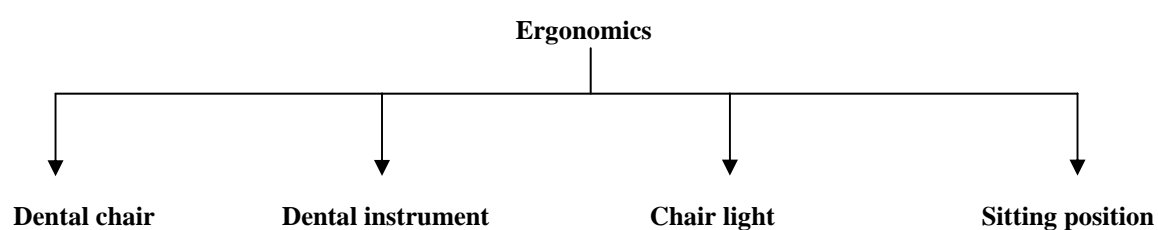
### Temperature, Ventilation and Humidity



### Noise

- Chronic auditory alterations

### Positioning Requirements



#### Dental Chair

- An angle of  $110^{\circ}$  or little higher between upper and lower legs during a sitting posture.
- The maximum depth and width of the seat shall be 40 cm and 43 cm respectively.
- A lumbar or pelvic support of 10 to 12 cm high that is adjustable vertically from 17-22 cm and for very tall dentists to 24 cm.
- An angle of  $25^{\circ}$  upwards and downwards rotation around horizontal axis for pelvic support.

#### Dental Instrument

##### Mirror Requirements

- The mirror to handle angle is  $45^{\circ}$
- Held in a vertical manner
- Held at the end of handle
- Smaller diameter for finite rotations
- Held in pendulum fashion

##### Other Instruments

- Hand instruments carrying tray has to be placed at a distance of 20 to 25 cm from the body of the dentist
- Working height for the dentist in a sitting and standing posture has to be a minimum of 78 cm to a maximum of 116 cm.

### **Chair Light**

- Large number of fluorescent lamps on the ceiling will provide with 500 lx for room illumination and 1000 lx for working area illumination
- Luminance of more than 20 cd/cm<sup>2</sup> cause squinting and running eyes.
- A light fitting with more than 200 cd/cm<sup>2</sup> should not be used
- Directed light for shielding the eyes of patients

### **Sitting Position<sup>9</sup>**

- Head could bend 20°-25°
- Arms should be close to the body
- Horizontally placed forearms (max.25% raised)
- Shank / thigh should be at 115°
- Soles should be on the floor
- Legs should be slightly apart (30°-45° angle)
- Shank has to be placed perpendicular on the floor
- Upper body should be perpendicular on the chair and it should not be associated with curvature of spine during the forward movements

### **Four-Handed Orthodontics**

#### **Requirement**

- Efficiency of the orthodontics can be increased by functioning with assistant
- Better communication between the dental assistant and orthodontist
- To have an uncomplicated orthodontic procedure, relatively less time consuming and to avoid iatrogenic injuries the shifting of instruments between the assistant and orthodontist to be carried out in transfer zone

### **Maintaining Ergonomic Posture**

Few requirements to be kept in mind before the dental professionals begin the procedure in a dental chair<sup>2,10</sup>

#### **Erect Posture**

- Chair close to patient
- Feet flat on the floor

#### **Adjustable Chair**

- Alteration in the height, tilt, width, back support

### Work Area

- Working tray close to the practitioner
- Avoid over extension
- Elbow, hip, knee and ankle forming 90°

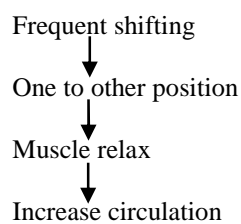
### Wrist Movements

- Avoid excessive movements
- Palm facing each other
- Shoulder width apart with wrist straight

### Finger Movements

- Avoid excessive movements
- Avoid repetitive movements

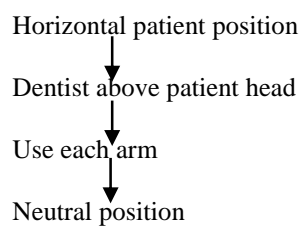
### Change of Position



### Adjust Chair

- Make the elbow, hip, knee and ankle forming 90°

### Patient Positioning



### Light

- Position light at appropriate level to avoid neck strain

### Temperature

- Decreased temperature will cause reduced circulation of blood in the periphery

## Musculoskeletal Disorders

Musculoskeletal pain is considered to a major problem among dental practitioners.<sup>11</sup>

The World Health Organization defines an Musculoskeletal disorder as “a disorder of the muscles, tendons, peripheral nerves or vascular system not directly resulting from an acute or instantaneous event (e.g., slips or falls). These disorders are considered to be work-related when the work environment and the performance of work contribute significantly, but are only one of a number of factors contributing to the causation of a multi factorial disease.<sup>12</sup>

According to the study conducted by Leggat PA and Smith DR suggested that young and less experienced dentist were more likely to suffer from musculoskeletal disorder of the neck, upper back and shoulder. The authors gave two possible explanations that experienced counterparts were able to cope and adjust with their working position handling instruments to avoid musculoskeletal problems. Second possible reason stated by authors’ were in those dentist who temporarily or permanently ceased their practice because of musculoskeletal disorder would thus not have been participated in the study.<sup>13</sup>

Musculoskeletal disorder among the dentist is found to have multifactorial aetiology.<sup>14</sup> Factors involved in the prevalence of disorder are<sup>14</sup>

- Duration of work
- Working environment
- Severity of stress
- Gender
- Experience
- Lack of satisfaction in work
- Anxiety during work
- Medically compromised patient
- Physical illness within the working dentist

The study conducted by Gopinadh A et al reported that frequency of pain was among 73.9% of subjects in their study. Around 30% experienced pain in more than one part of the body with male subjects being more affected than females. But multiple pain sites were common among females than males.<sup>15</sup>

The study conducted by Sankar SG et al reported that the prevalence of musculoskeletal disorder is found in 40% of Orthodontist. Increased prevalence of this disorder was noted among Orthodontists practicing more than 5 years and those working continuously without relaxation. They found that wrist pain and low back pain were more common musculoskeletal disorder among Orthodontic specialist. Authors reported that Indian Orthodontists was significantly affected by low back pain, shoulder and neck pain. This could be related to the general dental practice by them.<sup>3</sup>

Bhanat S et al in their review stated that Orthodontist smaller working area and inaccessible vision in the oral cavity results in back and neck problem. Such practicable difficulties craft them to take awkward position resulting in musculoskeletal disorder. The usual symptoms include low back pain, stiffness, tingling and muscle weakness. The hazard

of musculoskeletal disorder can be eliminated by frequent interruption between work, properly designed equipments, neutral and erect bodily position.<sup>16</sup>

## CONCLUSIONS

Dental professionals spend around 6000 hours in non ergonomic position in his entire lifetime, resulting in several musculoskeletal disorders.<sup>17</sup> Such muscle imbalances can be corrected by proper interventional procedures to maintain most favourable posture during their practice.<sup>17</sup> So, learning of proper ergonomic posture in dental chair side for treating the patients, consultation of occupational therapist for correction of musculoskeletal disorder, strengthening exercises for muscles of shoulders and neck with chair side strengthening, healing of trigger points before the strengthening exercises, and finally be patient.<sup>18</sup> Such objectives has to be satisfied and justified to fulfil the triad of ergonomic syndrome that is complete productivity of treatment plan, patient satisfaction and longevity in terms of professional career.

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